Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr ICV = 82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

Assessment of impact of BMI on blood pressure in obese subjects

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ABSTRACT:

Background: Hence; the present study to assess the impact of BMI on blood pressure in obese subjects. **Materials & methods:** A total 200 adult subjects both males and females comprising 100 non-obese and 100 obese subjects. **Selection criteria for obese subjects**: 100 obese adults (consisting of 65 adult subjects with BMI>30kg/m^2 and 82 adult pre-obese /overweight subjects with BMI >25 to 29.99 kg/m^2) subjects within the age group of 30 to 60 years who were attending OPDs in tertiary care hospital. **Selection criteria for non-obese subjects**: 100 non-obese adults (BMI > 18.50 to 24.99 kg/m^2) were selected on voluntarily participation from employees.Anthropometric measurement and blood pressure were recorded as follows: Height (Ht), Weight (Wt), Body mass index (BMI), Body Fat Percentage, waist circumference and hip circumference, Waist – Hip Ratio, Waist to Height Ratio, Mean BP and Mean arterial blood pressure (MAP). All the results were recorded and analyzed by SPSS software. **Results:** We observed a significant positive correlation present between body mass index and systolic blood pressure. A significant positive correlation was also observed in between body mass index and diastolic blood pressure and also positive correlation present between body mass index and mean arterial blood pressure. There was positive correlation present between waist circumference and BP parameters (SBP, DBP and MAP) in obese group and this positive correlation was found to be statistically significant. There was positive correlation present between waist circumference and systolic blood pressure. There was positive correlation seen in between waist circumference and diastolic blood pressure and also between waist circumference and mean arterial blood pressure. **Conclusion:** Clinicians should counsel their patients to maintain a healthy BMI or lose weight if they are overweight or obese in order to reduce the future risk of HTN and subsequent CVD.

Key words: Body Mass Index, Blood Pressure, Obese

Received: 15 December, 2019 Accepted: 17 January, 2020

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This article may be cited as: Singh G. Assessment of impact of BMI on blood pressure in obese subjects. J Adv Med Dent Scie Res 2020;8(2):241-244.

INTRODUCTION

Despite health policies implemented in the last decades and increasingly available therapeutic options, hypertension and cardiovascular disease (CVD) continue to be the main cause of disability, morbidity and mortality, both in Europe and in the United States. Primary and secondary prevention continues to address individuals who have experienced disease or present with one or more risk factors; furthermore, primordial prevention has been suggested for the attainment of global health at the population level. In fact, the World Health Organization (WHO) recently highlighted the importance of controlling blood pressure as millions of individuals have CVD worldwide, accounting for 31% of the world's population, of which 80% experience either heart diseases and stroke.[1-3]

Previous studies have documented the main factors of hypertension including age, gender, smoking, exercise, family history, dietary habits, and body mass index (BMI). The prevalence of obesity has been increasing throughout the world, including Europe. It is a decisive risk factor in many chronic diseases such as hypertension, dyslipidemia, and diabetes mellitus type 2. High body weight and obesity, by means of BMI measure, are the main causes of these disorders; hence, with the importance on continuous weight management, research is actively being conducted.[4-6]

Different anthropometric measurements like body mass index (BMI), waist circumference (WC), waist-to-hip ratio (WHpR), waist-to-height ratio (WHtR), subscapular skinfold thickness (SSF) or triceps skin fold (TSF) measurement as a part of index of trunk or peripheral skin folds are investigated for the purpose

of assessment of patients with elevated blood pressure.[7]

MATERIAL AND METHODS

A total 200 adult subjects both males and females comprising 100 non-obese and 100 obese subjects.

SELECTION CRITERIA FOR OBESE SUBJECTS

100 obese adults (consisting of 65 adult subjects with BMI>30kg/m^2 and 82 adult pre-obese /overweight subjects with BMI >25 to 29.99 kg/m^2) subjects within the age group of 30 to 60 years who were attending OPDs in tertiary care hospital.

SELECTION CRITERIA FOR NON-OBESE SUBJECTS

100 non-obese adults (BMI > 18.50 to 24.99 kg/m^2) were selected on voluntarily participation from employees.Anthropometric measurement and blood pressure were recorded as follows: Height (Ht), Weight (Wt), Body mass index (BMI), Body Fat Percentage, waist circumference and hip circumference, Waist – Hip Ratio, Waist to Height Ratio, Mean BP andMean arterial blood pressure (MAP). All the results were recorded and analyzed by SPSS software.

RESULT

We observed a significant positive correlation present between body mass index and systolic blood pressure. A significant positive correlation was also observed in between body mass index and diastolic blood pressure and also positive correlation present between body mass index and mean arterial blood pressure. There was positive correlation present between waist circumference and BP parameters (SBP, DBP and MAP) in obese group and this positive correlation was found to be statistically significant. There was positive correlation present between waist circumference and systolic blood pressure. There was positive correlation seen in between waist circumference and diastolic blood pressure and also between waist circumference and mean arterial blood pressure.

Table 1: Comparison of age, anthropometric and blood pressure parameters of obese (pre-obese + obese) and non-obese groups.

Study variable	Obese	Non-obese	p- value
AGE	47.2	46.5	0.515NS)
BMI	31.5	22.5	0.000(S)
BF%	41.3	28.6	0.000(S)
SSSFT	2.5	1.9	0.000(S)
WC	102.5	89.5	0.000(S)
WC/HIP	0.96	0.92	0.000(S)
WC/HT	0.71	0.59	0.000(S)
SBP	142.3	119.5	0.000(S)
DBP	93.5	815	0.000(S)
MAP	113.5	91.5	0.000(S)

S: Significant

Table 2: Correlation of anthropometric parameters with blood pressure parameters in obese group (n=200, pre-obese/overweight+obese subjects

Parameters	SBP	DBP	MAP
BMI	0.42(S)	0.49(S)	0.76(S)
WC	0.49(S)	0.38(S)	0.82(S)
WC/HT	0.32(S)	0.88(S)	0.68(S)
WC/HIP	0.38(S)	0.19(S)	0.46(S)
SS SFT	0.19(S)	0.56(S)	0.28(S)
BODY FAT%	0.31(S)	0.39(S)	0.18(S)

S: Significant

DISCUSSION

Due to industrialization and urbanization, the standard of living continues to rise particularly in developing countries. This has led to weight gain and obesity, which are posing a threat to the health of citizens. Obesity is perhaps the most prevalent form of malnutrition in developing countries, both among adults and children. Studies have demonstrated that obesity is related to elevated systolic blood pressure (SBP) and diastolic blood pressure (DBP) elevation, dyslipidemia, diabetes, etc. Obesity, its attendant health consequences and consequent health burden, is expected to reach epidemic proportions in developing countries like India. An increase in the dimension of this problem has been reported in the high socio-economic group in India. A study in Delhi revealed even higher prevalence (32-50%) of overweight (body mass index (BMI) >25) among adults

belonging to high income group as compared with 16.2-20% in those belonging to middle income group. BMI, calculated as weight in kg/height in meters squared, is most widely used to estimate the prevalence of obesity or underweight within a population.[7-11]

We observed a significant positive correlation present between body mass index and systolic blood pressure. A significant positive correlation was also observed in between body mass index and diastolic blood pressure and also positive correlation present between body mass index and mean arterial blood pressure. There was positive correlation present between waist circumference and BP parameters (SBP, DBP and MAP) in obese group and this positive correlation was found to be statistically significant. Landi F et al in another study, authors assessed the correlation of Body Mass Index with Hypertension. Theirstudy analyzed was conducted in 7907 community-living adults. According to the BMI cutoffs recommended by the World Health Organization, overweight status was observed among 2896 (38%) participants; the obesity status was identified in 1135 participants (15%), with 893 (11.8%) participants in class I, 186 (2.5%) in class II, and 56 (0.7%) in class III. Among enrollees with a normal BMI, the prevalence of hypertension was 45% compared with 67% among overweight participants, 79% in obesity class I and II, and up to 87% among participants with obesity class III (p for trend < 0.001). After adjusting for age, significantly different distributions of systolic and diastolic blood pressure across BMI levels were consistent. Overall, the average systolic blood pressure and diastolic blood pressure increased significantly and linearly across BMI levels. They found a gradient of increasing blood pressure with higher levels of BMI.[12]

In the present study, there was positive correlation present between waist circumference and systolic blood pressure. There was positive correlation seen in between waist circumference and diastolic blood pressure and also between waist circumference and mean arterial blood pressure. Chen H et al examined the impact of BMI on long-term BPV. Participants in the Kailuan study who attended all five annual physical examinations in 2006, 2008, 2010, 2012, and 2014 were selected as observation subjects. In total, 32,482 cases were included in the statistical analysis. According to the definition of obesity in China, BMI was divided into four groups: underweight ($BMI < 18.5$ kg/m2), normal weight ($18.5 \leq BMI < 24.0$ kg/m2), overweight ($24.0 \leq BMI < 28.0$ kg/m2), and obese ($BMI \geq 28.0$ kg/m2). Differences in ARVSBP by BMI group were analyzed using analysis of variance. Stepwise multivariate linear regression and multiple logistic regression analyses were used to assess the impact of BMI on ARVSBP. Participants' average age was 46.6 ± 11.3 years, 24,502 were men, and 7980 were women. As BMI increases, the mean value of ARVSBP gradually increases. After adjusting for other confounding factors, stepwise multivariate linear regression analysis showed that ARVSBP increased by 0.077 for every one-unit increase in BMI. Multiple logistic regression analysis indicated that being obese or overweight, compared with being normal-weight, were risk factors for an increase in ARVSBP. The corresponding odds ratios of being obese or overweight were 1.23 (1.15–1.37) and 1.10 (1.04–1.15), respectively. There was a positive correlation between BMI and ARVSBP, with ARVSBP increasing with a rise in BMI. BMI is a risk factor for an increase in ARVSBP.[13]

CONCLUSION

Clinicians should counsel their patients to maintain a healthy BMI or lose weight if they are overweight or obese in order to reduce the future risk of HTN and subsequent CVD.

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